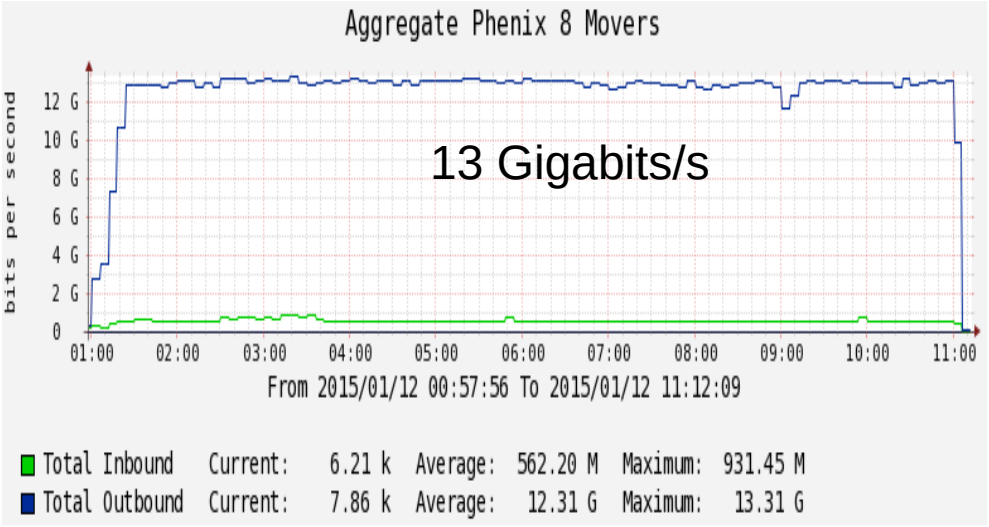
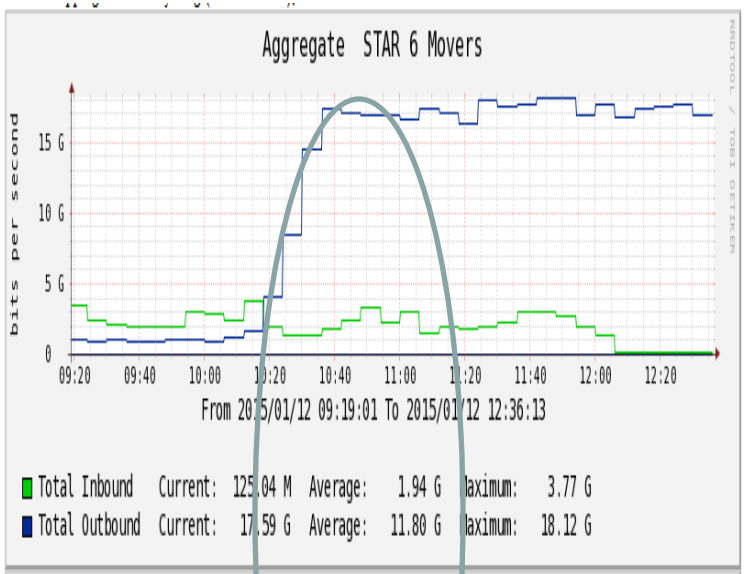
RCF Status - Introduction

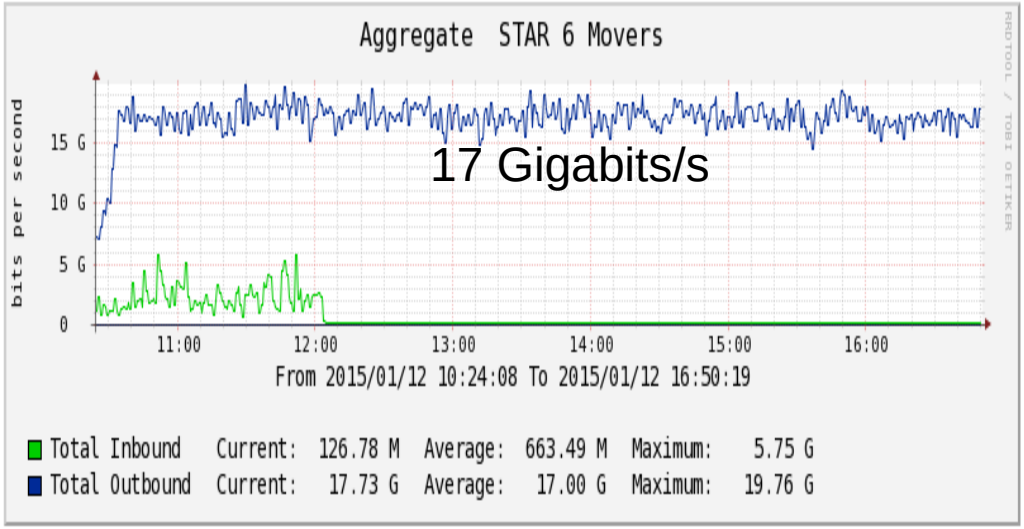
- PHENIX and STAR Counting Houses are connected to RCF at a Network Bandwidth of 20 Gbits/sec each
  - Redundant (Bandwidth-wise and using path diversity)
- In preparation of the upcoming RHIC RUN PHENIX, STAR and RCF have conducted a Mock Data Challenge yesterday and today
  - Goal is to assess the performance and reliability of the entire chain
    - From DAQ to Data on Tape
    - Incl. Experiment Transfer Nodes, Network, RCF Storage Infrastructure
  - Random data was transferred from the STAR and PHENIX Counting Houses to the High Performance Storage System (HPSS) at RCF.
    - Using the same components as will be used during the Run
    - Demonstrated Experiments can push up to 2 GBytes/s each from CH to RCF storage system
      - Observed at to 3.7 Gigabytes/s from the CHs to the RCF Storage System
    - Staging data FROM Tape while writing TO Tape
      - Overlapping writing to/reading from tape essential for PHENIX & STAR
- Increased resource requirements for Analysis of Run14 data and for the Runs in the next few years

Mock Data Challenge (MOC)

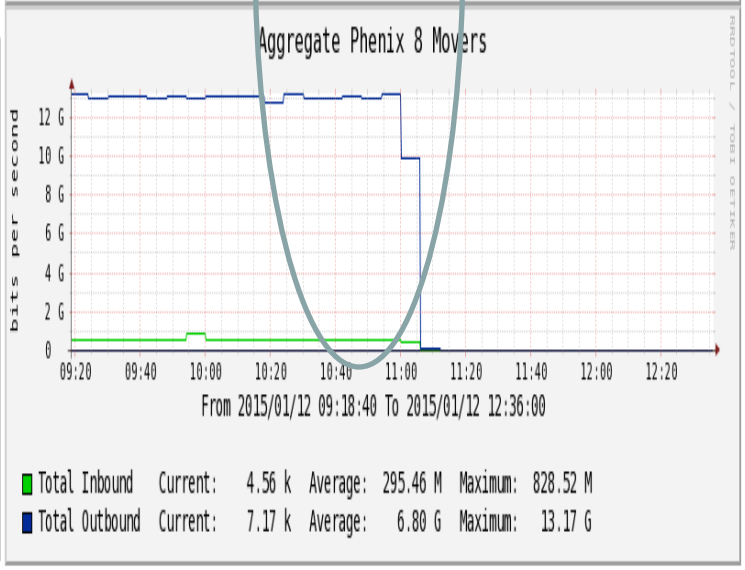


13 Gigabits/s





17 Gigabits/s



STAR and PHENIX Beam Use

STAR

RHIC run Year	Species	Initial Number of events from the 2013 computing plan (B=Billion, M=Million)	Actual number of events or revised planning since the ESnet report
2014	Au+Au 200 GeV Au+Au 15 GeV	2 B (minbias, central) + ~ 0.78 B misc 20 M 3 PB	6.6 B events total 7 PB
2015	p+p 200 GeV p+Au 200 GeV	2.2 B (2 B minbias + trigger mix) 600 M 3 PB	~ 5 B events planned and in discussion 5 PB
2016	Au+Au 200 GeV	4.2 B (4 B minbias, …) – large sample 6 PB	~ 6.6 B envisioned, matching the 2014 data sample in size 10 PB

PHENIX

Run	System	Energy	duration	size [TB]
Run 15	pp	200 GeV	9 weeks	600
Run 15	pAu	200 GeV	5 weeks	700
Run 15	pAl	200 GeV	2 weeks	200
total				1500

Run	System	Energy	duration	size [TB]
Run 16	pp	62 GeV	6.5 weeks	200
Run 16	AuAu	62 GeV	9 weeks	900
Run 16	pp	510 GeV	1 week	100
Run 16	*AuAu*	*200 GeV*	*10 weeks*	*4500*
Run 17	RHIC cooling upgrade, decommission PHENIX			
Run 18	no sPHENIX participation planned			
total				1200 (*5700*)

STAR and PHENIX Beam Use

STAR

RHIC run Year	Species	Initial Number of events from the 2013 computing plan (B=Billion, M=Million)	Actual number of events or revised planning since August 2013
2014	Au+Au 200 GeV Au+Au 15 GeV	2 B (minbias, central) + ~ 0.78 B misc 20 M 3 PB	6.6 B events total 7 PB
2015	p+p 200 GeV p+Au 200 GeV	2.2 B (2 B minbias + trigger mix) 600 M 3 PB	~ 5 B events planned and in discussion 5 PB
2016	Au+Au 200 GeV	4.2 B (4 B minbias, …) – large sample 6 PB	~ 6.6 B envisioned, matching the 2014 data sample in size 10 PB

And this is just the RAW dataset

- MuDST adds 4 PB in 2015, 3 PB in '16 and 4 PB in 2017

STAR requires ~28 PB of Storage Space in addition to what STAR Is using today

PHENIX

Run	System	Energy	duration	size [TB]
Run 15	pp	200 GeV	9 weeks	600
Run 15	pAu	200 GeV	5 weeks	700
Run 15	pAl	200 GeV	2 weeks	200
		total		1500

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Run 16	*AuAu*	*200 GeV*	*10 weeks*	*4500*
Run 17	RHIC cooling upgrade, decommission PHENIX			
Run 18	no sPHENIX participation planned			
			total	1200 (*5700*)

PHENIX will need 11 PB (incl AuAu in 16)

Adds up to a total add. space of 39 PB by '17

PHENIX and STAR Production Plans

(Resource permitting)

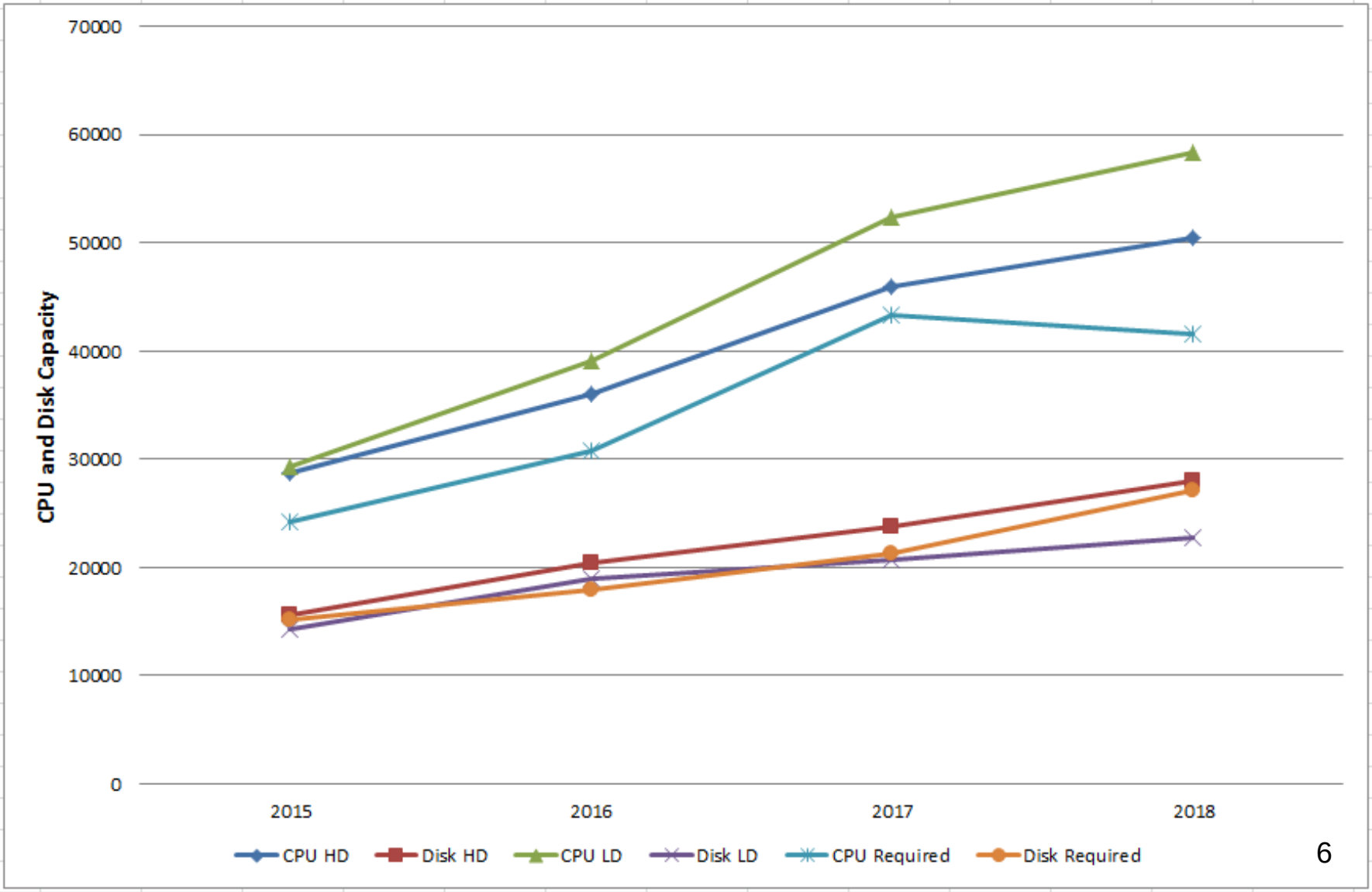
STAR

General production plan (months)	2014	2015	2016	2017	2018
Fast-calib and special requests	2.00	1.00	1.00	0.00	1.00
Calibration for data production		1.00	2.00	2.00	2.00
Additional calibration R&D	2.00	1.00	1.00	1.00	1.00
Data pre-2013 repass (Run 12, ...)			1.67		
0.5 passes of Run 13	2.68				
Run 13 repass / consolidation			3.34		
0.7 then 1 pass of year 14		6.48		5.78	
0.5 then 1 pass year 15			1.15		1.64
0.5 passes, then (0.5+0.5) of run 16				4.11	3.75
1.5 passes of run 18					
1 pass of run 19					
Total assuming HD scenario (months)	6.68	9.48	10.16	12.90	9.39
HD scenario +15% contingency	7.69	10.90	11.69	**14.83**	10.80
Total assuming LD scenario (months)	6.68	9.29	9.37	11.32	9.39
LD scenario + 15% contingency	7.69	10.68	10.78	**13.02**	9.33

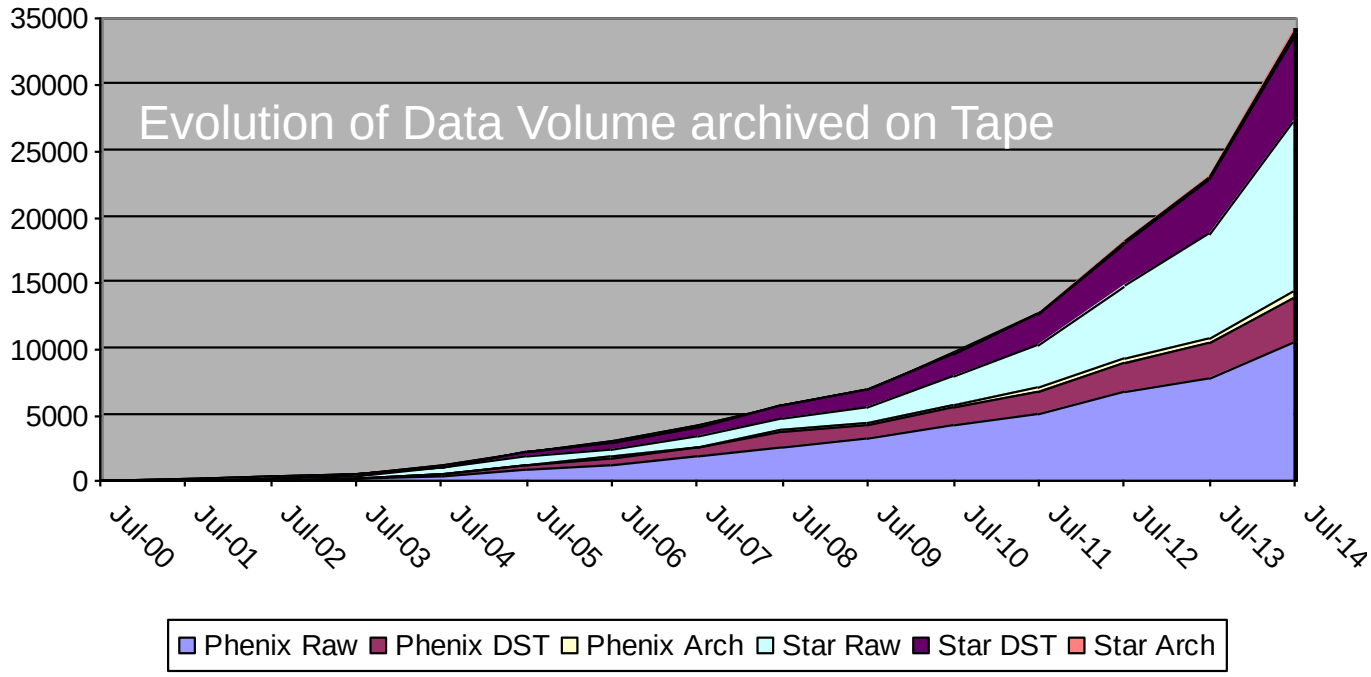
PHENIX

Productions	data files (10GB)	processing time per file	2015	2016	2017	2018
Run 14	300000	100h	125d	-	-	-
Run 15	150000	50h	20d	10d	-	-
Run 16	120000	100h	-	25d	-	-
Run 16 AuAu	*450000*	*100h*	-	*75d*	*120d*	-

RCF Capacity Requirements



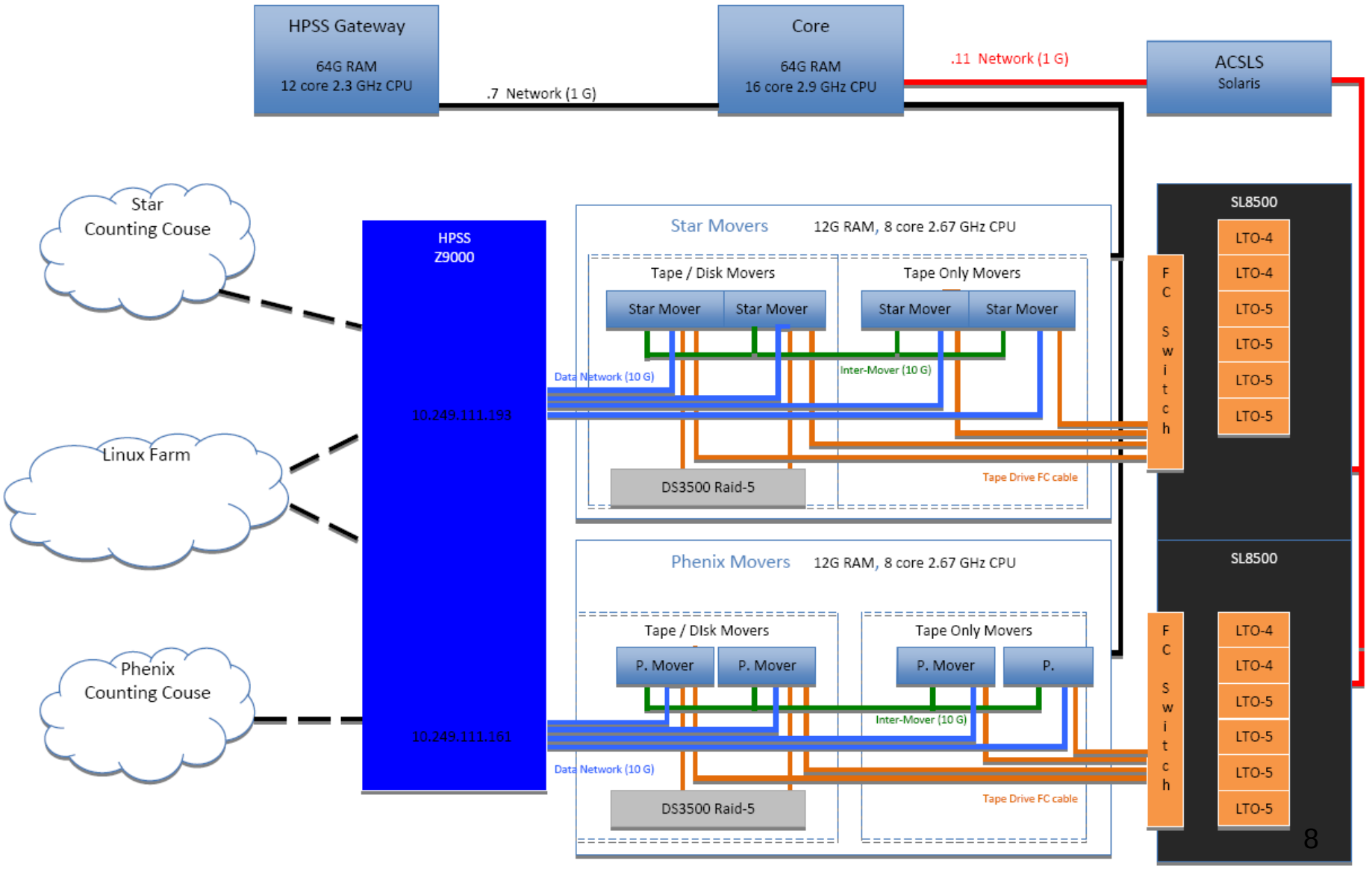
Archival Storage System



Data volume collected in Run10-Run14 increased progressively

- 2/3 or ~26 PB were created and archived in 5 years (2010-2014)
- Entire archived volume is “active” data – Analyses today going back to data from early Runs

HPSS Mass Storage System Overview



Archival System Resources and Performance

Experiment	
PHENIX	
Nb of Tape Drives	18
Max. B/W per Tape Drive [MB/s]	130
HPSS Cache Size [TB]	53
Cache B/W [GB/s]	5
Aggregate B/W to Tape[MB/s]	2340
B/W to Tape in Run15 [MB/s]	520
Aggregate B/W from Tape	1980
B/W from Tape during Run15 [MB/s]	1500
STAR	
Nb of Tape Drives	18
Max. B/W per Tape Drive [MB/s]	130
HPSS Cache Size [TB]	53
Cache B/W [GB/s]	5
Aggregate B/W to Tape	2340
B/W to Tape in Run15 [MB/s]	1300
Aggregate B/W from Tape	1980
B/W from Tape during Run15 [MB/s]	1040
Available Archive Capacity [TB]	35700

Conclusion

- RCF is prepared for data taking at PHENIX and STAR at the required level of performance
- The RCF architecture allows to support overlapping data taking and production and analysis activities at the level of performance commensurate with the physics goals of the collaborations.
  - This is contingent to the level of RCF funding in FY15 – FY18